Tilte

ELECTROMAGNETIC PUMP

Field of the Present Invention

The present invention relates generally to a piston pump, and more particularly to an electromagnetic pump comprising a cylinder, two induction coils, and a piston which is forced by two opposite excitations to engage in a reciprocating linear movement within the cylinder.

Background of the Present Invention

As illustrated in FIGS. 1 and 2, a prior art pump 10 comprises a fluid pipe 11 and a cylinder 12 extending from the fluid pipe 11. The fluid pipe 11 is provided at one end with an input valve 13, and at other end with an output valve 14. The cylinder 12 is extended from the midsegment of the fluid pipe 11 and is provided therein with a snug-fitting piston 15. The piston 15 fastened at one end with a driving meohanism 16 by which the piston 15 is forced to move back and forth within the cylinder 12. When the piston 15 moves to an outer end of the cylinder 12, a suction force is created within the fluid pipe 11 to cause the input valve 13 to open up, as shown in FIG 1, thereby allowing entry of the fluid into the cylinder 12. When the piston 15 is forced by the driving mechanism 16 to move in a direction toward the fluid pipe 11, the fluid in the cylinder 12 is forced to move toward the input valve 13 and the output valve 14, as indicated by arrows in FIG 2. The input valve 13 is therefore forced by the fluid pressure to remain close, while the output valve 14 is forced by the fluid pressure to open up to allow passage of the fluid.

Such a prior art pump as described above has several shortcomings. In the first place, it has a relatively large volume due to the driving mechanism 16. In light of the large overall volume of the prior art pump 10, it is often too large to be fitted into such appliances as dehumidifier, computer, water bed, reverse-osmosis machine, and the miniaturized icy water server. The piston 15 is fastened at one end with the driving mechanism 16, thereby allowing only the free end of the piston 15 to engage in the actions of driving the fluid into and out of the fluid pipe 11. In another words, the efficiency of the piston 15 is unduly compromised. As shown by an enlarged portion of FIG 1, the piston 15 is pr vided with a washer fitted there ver. The washer is apt to

wear out easily by the mechanical friction between the washer and the inner wall of the cylinder 12. The replacement of the worn-out washer gives an added cost to the maintenance of the prior art pump 10. Moreover, the prior art pump 10 is made according to a specification and is therefore not versatile in terms of the fluid discharge.

Summary of the Present Invention

The primary objective of the present invention is to provide an electromagnetic pump which is free of the deficiencies of the prior art pump described above.

In keeping with the principle of the present invention, the foregoing objective of the present invention is attained by the electromagnetic pump comprising a cylinder, a piston, and two induction coils. The piston is magnetically excited by two opp site magnetic forces brought about by the two induction coils, so as to move linearly within the cylinder in a reciprocating manner. In light of absence of mechanical mechanism by means of which the piston of the conventional pump is driven, the electromagnetic pump of the present invention can be miniaturized. The electromagnetic pump of the present invention is relatively more efficient, thanks to the magnetically-driven piston whose both ends are engageable with the pumping of fluids. As the piston is driven to move back and forth within the cylinder, there is lack of a mechanical friction between the piston and the cylinder. As a result, the service life span of the piston is greatly prolonged. The maintenance cost of the piston is also reduced by virtue of the fact that the piston is devoid of a washer. The electromagnetic pump of the present invention is operated by the excitation which can be adjusted in intensity by a current oscillation frequency, thereby enabling the piston to be driven at various rates so as to enhance versatility of the electromagnetic pump of the present invention.

The features and the advantages of the present invention will be more readily understood upon a thoughtful deliberation of the following detailed description of the present invention with reference to the accompanying drawings.

Brief Description of the Drawings

FIGS. 1 and 2 show schematic views of a prior art pump in action.

FIG 3 shows a perspective view of the present invention.

FIG 4 shows a sectional schematic view taken in the direction indicated by a line A-A as shown in FIG3.

FIG 5 shows an exploded view of the present invention.

FIGS. 6 and 7 are schematic views of the present invention in action.

FIG 8 shows another sectional view taken along the direction indicated by the line A-A as shown in FIG 3.

FIG 9 shows a modified version of the connection pipe of the present invention.

Detailed Description of the Preferred Embodiment

As shown in FIGS. 3, 4 and 5, an electromagnetic pump embodied in the present invention comprises a cylinder 20, a magnetic piston 30, a first induction coil 40, a second induction coil 50, and a magnetic housing 60.

The cylinder 20 has a closed end 21 and an open end 22. The closed end 21 is provided with an axial hole 211. The open end 22 is provided with a connection pipe 23. The cylinder 20 is provided in the interior with a piston chamber 24 situated between the closed end 21 and the connection pipe 23.

The magnetic piston 30 is slidably disposed in the piston chamber 24 of the cylinder 20 and is provided with a first end face 31 and a second end face 32.

The first induction coil 40 is fitted over one end of the cylinder 20 and is provided with a first excitation hole 41 extending along an axial direction thereof, a first power source wire 42, and a first excitation frame 43. The first excitation frame 43 and the first excitation hole 41 are respectively provided in the corresponding side with a through hole 431, 432.

The second induction coil 50 is fitted over other end of the cylinder 20 and is provided with a second excitation hole 51 extending along an axial direction thereof, a second power source wire 52, and a second excitation frame 53. The second excitation frame 53 and the second excitation hole 51 are respectively provided in the corresponding side with a through hole 531, 32.

The magnetic housing 60 is provided in two ends with a seat 61, 62 for securing respectively the closed end 21 and the open end 22 of the cylinder 20.

As shown in FIGS. 6 and 7, the present invention is incorp rated into a water draining system 70, which c mprises a first drain pipe 71 and a second drain pipe 72.

The first drain pipe 71 and the second drain pipe 72 are respectively provid d in the front segment and the rear segment with a check valve 711, 712; 721,722, with the midsegment thereof being connected with the closed end 21 and the connection pipe 23 of the cylinder 20.

As illustrated in FIGS. 4, 6, 7 and 8, when the power supply is made available to the first induction coil 40 via the first power source wire 42, the first induction coil 40 produces an excitation. The first excitation frame 43 produces two magnetic force lines of the north magnetic pole and the south magnetic pole. As a result, the piston 30 is attracted to move in the direction toward the first excitation frame 43. In the course of the movement of t he piston 30, the first end face 31 of the piston 30 forces water (W1) at the closed end 21 into the first drain pipe 71, as indicated by arrow in FIG. 6. The water is discharged via the check valve 712. Meanwhile, water (W2) in the second drain pipe72 flows into the piston chamber 24 of the cylinder 20 via the connection pipe 23 such that the water is kept between the second end face 32 of the piston 30 and the connection pipe 23. As the current interruptions take place such that the power source is made available to the second induction coil 50 via the second power source wire 52, the second induction coil 50 produces an excitation. As a result, the second excitation frame 53 produces two magnetic force lines of the north pole and the south pole. The piston 30 is thus attracted to slide toward the second excitation frame 53, as shown in FIG. 8. The second end face 32 of the piston 30 forces the water (W2) into the second drain pipe 72, as shown in FIG. 7. The water is discharged by the check valve 722. The piston 30 is driven to move linearly in the piston chamber 24 of the cylinder 20 in a reciprocating manner by the magnetic forces which are produced in the wake of the excitations of the first excitation frame 43 and the second excitation frame 53. In another words, the piston 30 draws in the water and forces out the water.

Whenever an excitation is effected by the first induction coil 40 or the second induction coil 50, the magnetic housing 60 produces simultaneously a counter magnetic force, by means of which the piston 30 is magnetically floated in the piston chamber 24 of the cylinder 20. As a result, there is absence of a mechanical friction between the piston 30 and the wall of the piston chamber 24. The piston 30 is thus prevented from being worn out by the mechanical friction.

As shown in FIG. 9, a modified connection pipe 23' of the present invention is provided with a shallow annular groove 231 which is disposed in a wall of the modified connecti n pipe 23', with the wall coming in contact with the cylinder 20. The annular groove 231 is used to locate an annular ring 232, by means of which the cylinder 20 and the connection pipe 23' are isolated to prevent leak.

The embodiments of the present inv nti n described above serve to illustrate the features and the advantages of the present invention over the prior art pump. The piston of the present invention is magnetically driven, thereby resulting in a substantial reduction in volume of the pump of the present invention. The present invention can be thus miniaturized to broaden its application. The magnetically-driven piston of the present invention moves back and forth in the cylinder without causing a mechanical friction, thereby preventing the piston from being worn out. The versatility of the pump of the present invention is enhanced by a circuit design enabling the rate of the linear motion of the piston of the present invention to be adjusted by the current oscillation frequency .

The embodiments described above are to be regarded in all respects as being illustrative and nonrestrictive. Accordingly, the present invention may be embodied in other specific forms without deviating from the spirit thereof. The present invention is therefore to be limited only by the scopes of the following claims.